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COMPLETE SPECIFICATION

# Improvements in or relating to Portable Electric Tools

I, FRIEDRICH DUSS, a German citizen, personally responsible partner of the firm of Friedrich Duss Maschinenfabrik, of Neubulach, District of Calw, Germany, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to portable electric tools and has as its object the provision of a portable electric tool which will be more efficient in use than such tools commonly in use hitherto.

The invention provides a portable electric tool including a rotary tool-member, an electric motor for rotating the tool-member, a housing which surrounds the motor and a rotary vaned member which is adapted to cause air to flow through the housing to cool the motor, wherein the vaned member is driven by the motor by means of speed-multiplying gearing such that the vaned member is given a rotational speed at least equal to the rotational speed of the tool-member.

The rotation of the vaned member at a speed at least equal to the rotational speed of the tool-member produces a strong current of air through the housing and thus ensures thorough cooling of the motor. This enhanced cooling effect may make it possible to operate the motor at a considerably higher speed than has hitherto been customary or it may on the other hand, facilitate the use, in a tool of a given size, of a motor which is smaller and lighter in weight than would normally have been used in such a tool hitherto.

The invention will now be more fully described with reference to the accompanying drawings in which:—

Figure 1 is a longitudinal section through one form of portable electric tool constructed in accordance with the invention;

Figure 2 is a transverse section on the line A—B in Figure 1, and

Figure 3 is a longitudinal section through another form of portable electric tool constructed in accordance with the invention.

Referring to Figures 1 and 2, a portable electric tool comprises a generally cylindrical housing 1 which surrounds an electric motor M. The end walls 2 and 18 of the housing are shaped to provide mountings or hubs 10 and $10^1$ in which are mounted bearings for the rotor shaft 9 of the motor M. Over the wall 2 there is secured a hand-grip 3. The hand-grip 3 is shaped to provide a space which is sufficiently large to accommodate a switch for the motor when required. Moreover, it has a tubular portion for the admission of an electric supply cable for the motor M. Both the wall 2 and the hand-grip 3 are formed with inlets $2^1$ and $3^1$ respectively by means of which air is admitted to the motor housing 1.

A casing 4 is secured over the wall 18 of the housing 1, the casing 4 being formed with a mounting $4^1$ which supports a bearing in which is journalled a spindle 14. The spindle 14 carries a rotary tool-member which, in the case of the tool shown in the drawing, is a flexible grinding disc 7. Such a grinding disc may be made of perlon or nylon, with particles of an abrasive material incorporated therein or adhering thereto. The grinding disc is preferably designed to be suitable for speeds of at least 80m/secs.

A vaned member or fan 6 is mounted on the spindle 14, externally of the housing 1 and adjacent to the grinding disc 7, and rotates with the latter. A shield 5 is secured to the housing 1 and casing 4 and defines a space within which the fan 6 is located, the grinding disc 7 also being partly located within the space defined by the shield. When the tool is in use, the shield 5 bears against the work. The shield 5 is formed with an opening which communicates with an opening formed in the housing 1 and thus connects the interior of the housing with the space defined by the shield. In this way, air exhausted from the housing 1 by the fan 6 is guided by the shield to flow around the disc 7 and around

the work. The spindle 14 is driven by the motor M by means of a pair of bevel bears 12, 13 which provide a speed-multiplying transmission having a gear ratio 1:3 so that the fan 6 and the disc 7 rotate together at high speed.

The motor M is preferably of a type providing a rotational speed of about 3000 r.p.m. The rotor shaft 9 of the motor is tubular and extends partly inside and partly outside the housing 1. The shaft 9 is formed with slots or openings $9^1$ which are located inside the housing 1 and it is also open at one end, this opening $9^{11}$ being located outside the housing 1.

The stator winding 8 and core $8^1$ of the motor M are arranged within the housing 1 in such a way as to define with the latter a space 28 of annular cross-section. Thus, when the tool is in use, the action of the fan 6 draws ambient air through the openings $3^1$ into the interior of the hand-grip 3 and thence either through the openings $2^1$ and the space 28 to cool the stator or through the openings $9^1$ and $9^{11}$ to cool the rotor.

Referring now to Figure 3, those parts of the tool shown therein which correspond to parts of the tool shown in Figures 1 and 2 are identified by the same reference numerals as the latter. In the tool shown in Figure 3, the arrangement is such that cooling air drawn in through openings 23 formed in the housing 1 passes through the motor housing 1 but does not flow around the grinding disc 7 or around the work. Instead it is exhausted from the housing 1 through an opening 21 formed in the wall 2 and thence passes through openings formed in the hand-grip 3. In order to increase the effectiveness of the fan 6, a plate 22 is mounted in the internal space of the hand-grip.

The rotor shaft 9 of the motor M is extended through the wall 2 and carries a gear wheel 15 which meshes with a pinion 16 mounted upon an axle 17 which carries the fan 6. The gears 15 and 16 preferably have a ratio of about 1:4 so that if the rotational speed of the rotor shaft 9 is 3000 r.p.m. the fan 6 has a rotational speed of 12000 r.p.m. As in the case of the tool shown in Figures 1 and 2, the disc 7 is mounted on a spindle 14 which is driven by the motor M by means of speed-multiplying gears 12 and 13, having a gear-ratio of 1:3. The fan 6 therefore rotates at a speed greater than that of the disc 7. The heat of the motor is thus dissipated even more effectively than in the tool shown in Figures 1 and 2, but without any significant increase in power consumption.

Many modifications may be made in the tools hereinbefore described without departing from the scope of the invention as defined by the claims. For example, while in both the tools shown in the drawings the fan 6 is constructed and positioned so as to exhaust air from the housing 1, it is possible for the fan to be constructed and positioned so as to force air into the housing. In the case of the tool shown in Figures 1 and 2, this has the advantage that the current of air passing does not blow swarf about the place of work. In the tool shown in Figure 3, since the fan 6 is driven by speed-multiplying gearing independently of the tool-member 7, the latter can, if desired, be driven directly from the shaft 9 without the use of gears 12 and 13.

What I claim is:—

1. A portable electric tool including a rotary tool-member, an electric motor for rotating the tool-member, a housing which surrounds the motor and a rotary vaned member which is adapted to cause air to flow through the housing to cool the motor, wherein the vaned member is driven by the motor by means of speed-multiplying gearing such that the vaned member is given a rotational speed at least equal to the rotational speed of the tool-member.

2. A tool as claimed in Claim 1, wherein the vaned member is located externally of the housing.

3. A tool as claimed in Claim 2, wherein the vaned member is constructed and positioned so as to force air into the housing.

4. A tool as claimed in Claim 2, wherein the vaned member is constructed and positioned so as to exhaust air from the housing.

5. A tool as claimed in any of the preceding claims, wherein the tool-member is mounted on a spindle which is driven from the motor by means of a pair of bevel gears which provide a speed-multiplying transmission.

6. A tool as claimed in Claim 5, wherein the vaned member is mounted on the said spindle, adjacent to the tool-member, and rotates with the latter.

7. A tool as claimed in Claim 5, wherein the vaned member is driven from the motor by means of a pair of gear wheels which provide a speed-multiplying transmission having a gear ratio at least as great as that of the said bevel gears.

8. A tool as claimed in Claim 6, wherein a shield is provided which defines a space within which the tool-member and the vaned member are at least partly located and wherein the shield is formed with an opening which communicates with an opening formed in the housing so as to connect the interior of the housing with the space defined by the shield, so that air flowing through the housing is guided by the shield to flow around the tool-member.

9. A tool as claimed in Claim 8, wherein the shield is adapted to bear against the work.

10. A tool as claimed in any of the preceding claims wherein the tool-member is an abrasive disc.

11. A tool as claimed in any of the preceding claims wherein the motor includes a

tubular rotor-shaft which extends partly inside and partly outside the housing and which is formed with at least one opening located inside the housing and at least one opening located outside the housing, the arrangement being such that ambient air flows through the rotor-shaft in order to cool it.

12. A tool as claimed in any of the preceding claims, wherein the motor includes a stator core and winding which are arranged within the housing in such a way as to define with the latter a space of annular cross-section and wherein the housing is formed with at least one inlet and at least one outlet which are so positioned that air flows through the annular space so as to cool the stator core and winding.

13. Portable electric tools substantially as herein described with reference to Figures 1 and 2 and Figure 3 of the accompanying drawings.

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Fig. 2

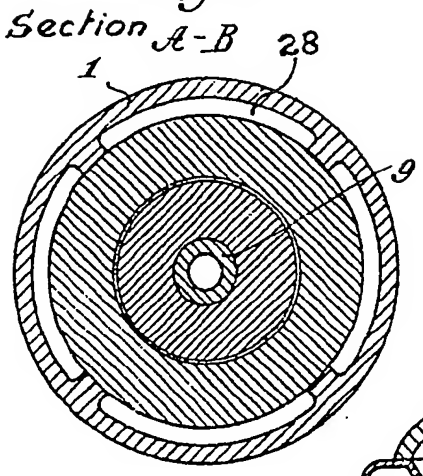



Fig. 1

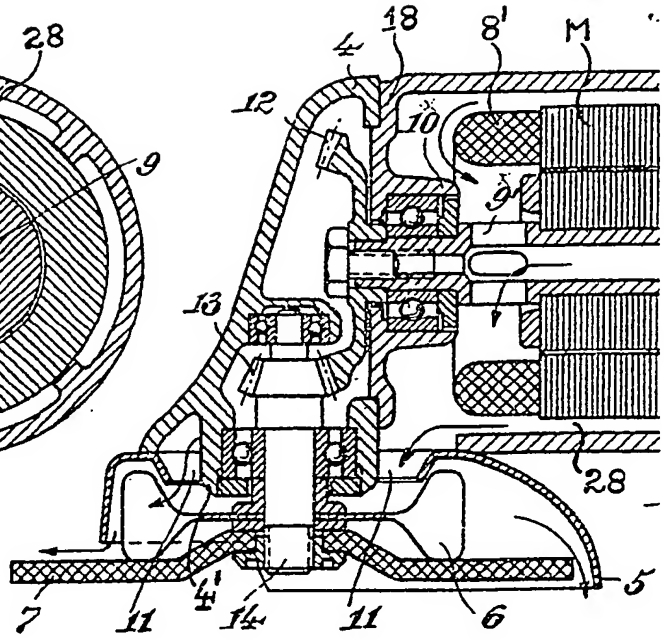
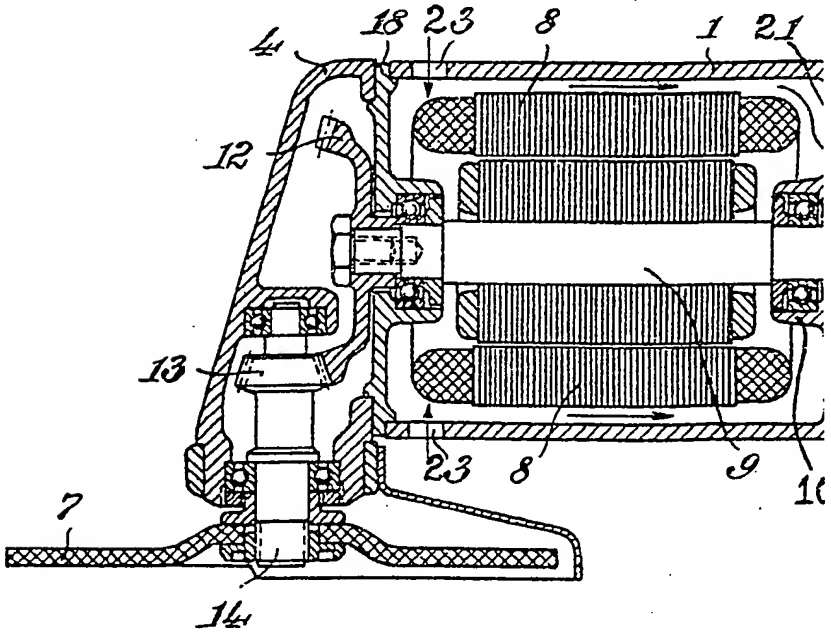



Fig. 3



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This drawing is a reproduction of the Original on a reduced scale.

Fig. 1

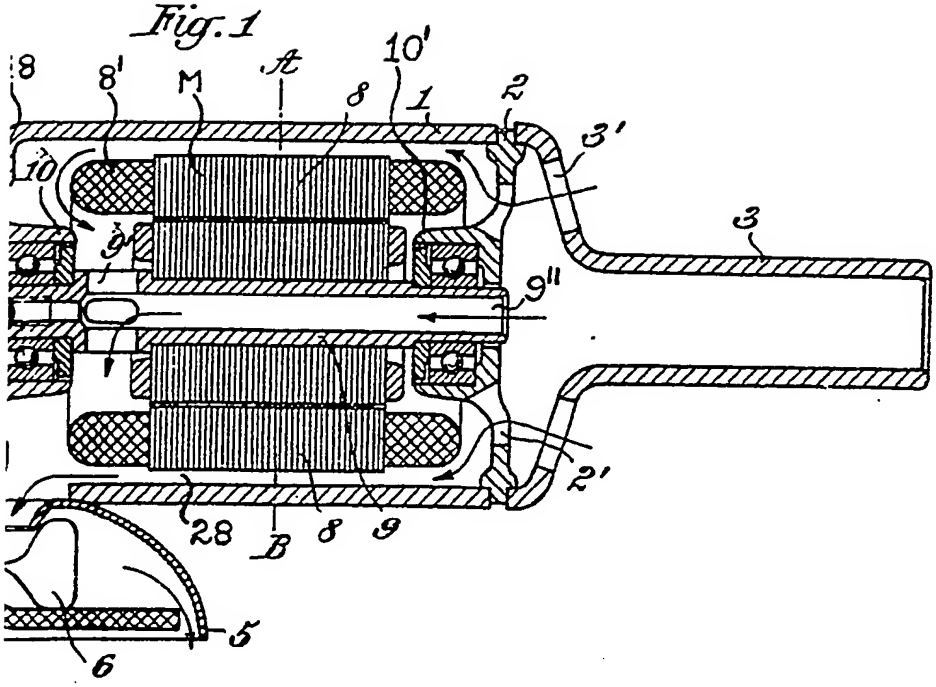


Fig. 3

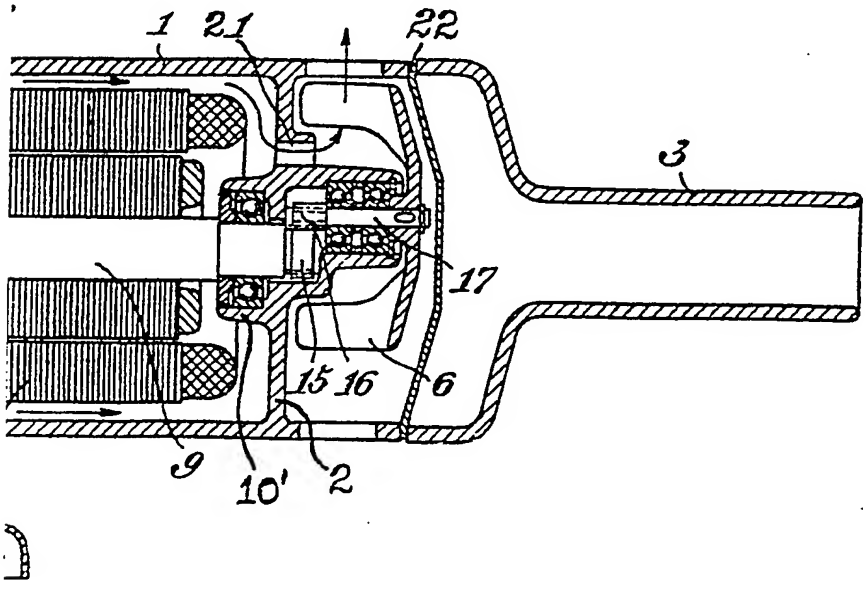

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Fig. 2

Section A-B

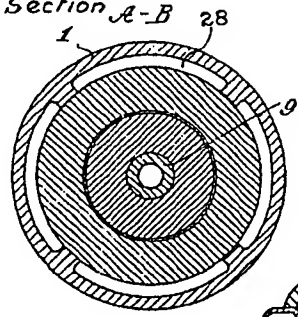


Fig. 1

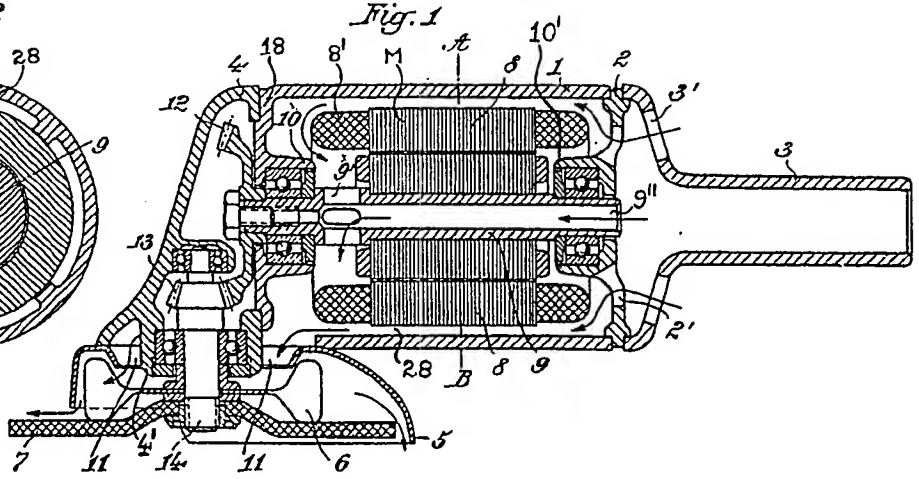


Fig. 3